Original Article

The Effect of the COVID-19 Pandemic on Post-PCI Outcomes: A Study of First Event Occurrences

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ABSTRACT

Background: Previous studies have reported a higher incidence of ischemic events in African Americans (AAs) than in non-AAs following percutaneous coronary intervention (PCI). Moreover, AAs are known to experience worse COVID-19-related outcomes. However, the impact of the COVID-19 pandemic on the first occurrence of ischemic events among race and gender-stratified post-PCI patients remains unknown.

Methods: In this retrospective study, we compared patient demographics and the first adverse events post-PCI before (2018-2020) and during (2020-2021) the COVID-19 pandemic. Continuous variables were expressed as mean ± standard deviation and compared using the 2-sample *t*-test, while categorical variables were compared using the χ^2 test. Univariate and multivariate logistic regression analyses were performed using Stata17 software.

Results: The study population consisted of 1022 patients, with 511 patients before and 511 after the onset of the pandemic. The first occurrence of cardiovascular death, ischemic events, and myocardial infarction was higher during the COVID-19 pandemic than during the pre-pandemic period ($P<0.05$). During the pandemic, AAs experienced a significantly higher incidence of first ischemic events than non-AAs ($P=0.03$). Notably, AA men had significantly higher rates of ischemic events than AA women, non-AA men, and non-AA women during the COVID-19 pandemic ($P<0.05$).

Conclusions: These findings further emphasize the importance of addressing the increased thrombogenic risk among AAs, who exhibit higher ischemic risk than their non-AA counterparts. ***(Iranian Heart Journal 2024; 25(3): 35-50)***

KEYWORDS: COVID-19, Percutaneous coronary intervention, African Americans, Disparities

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In the United States, racial and ethnic minority populations are rapidly growing, with a projected decline in the non-Hispanic white population from 60% in 2014 to 44% in 2060.[1] Randomized controlled trials assessing coronary stenting have reported a higher prevalence of adverse cardiovascular (CV) outcomes in African Americans (AAs) than in non-AAs.[2] This racial disparity is likely multifactorial, including lack of awareness, a higher prevalence of risk factors, delayed treatment, and access to health care.[3-5] Some studies suggest that outcomes after coronary stenting vary by race and cannot be fully explained by baseline risk factors and treatment characteristics.[6, 7] Genetic variants and elevated intrinsic propensity for thrombosis might also play a role.[8, 9] In particular, AA women are noted to have an elevated risk of cardiovascular disease (CVD) and intrinsic thrombogenicity.[10-12]

The COVID-19 pandemic has further exposed longstanding health inequities in the United States, with disproportionately higher infections, hospitalizations, and adverse outcomes in Black individuals.[13, 14] The pandemic has also led to worsening racial and gender disparities in CVD risk factors and adverse outcomes.[15, 16] During the early pandemic, percutaneous coronary intervention (PCI) procedures were severely affected.[15] Nonetheless, studies assessing the influence of the pandemic on post-PCI first adverse outcomes are limited.

To gain further insight into the effect of the pandemic on healthcare disparities, we performed this study in the unique setting offered by the Baltimore population, where equal proportions of AAs and Caucasians are admitted for PCI.

METHODS

This single-center retrospective cohort study analyzed patients who underwent PCI before the COVID-19 pandemic (01/01/2018 to 01/20/2020) and during the pandemic (01/21/2020 to 12/31/2021). This cohort was previously used in our study assessing overall PCI outcomes.[17] We obtained institutional review board approval from the Ethics Committee at Sinai Hospital of Baltimore. Patient demographics, baseline comorbidities, baseline medications, relevant medical history, discharge medications, and laboratory values on index admission for PCI were obtained from the hospital's electronic medical records. Patients were followed up for up to 1 year to assess major adverse CV outcomes, including CV death, myocardial infarction (MI), stent thrombosis, revascularization, and thrombolysis in myocardial infarction (TIMI) bleeding. The first ischemic event occurrences (defined as CV death, MI, stent thrombosis, and revascularization) were also identified separately.

Statistical Analysis

Continuous variables were expressed as mean ± standard deviation and compared using the 2-sample *t*-test. Categorical variables were presented as numbers and percentages and compared using the χ^2 test. Descriptive analysis was also performed for the categorical variables. Logistic regression analysis was used to calculate the odds ratio (OR), but multivariate regression could not be performed due to the small number of events in each cohort. A *P* value of less than 0.05 was considered statistically significant. All statistical analyses were performed using Stata17 software (StataCorp, College Station, TX, USA).

The cohort was divided into AAs and non-AAs (all other races). Baseline comorbidities, laboratory values, and medications were compared within the same ethnic group before and during the pandemic, as well as between AAs and non-AAs. Total adverse events, including ischemic and TIMI bleeding, were compared before and during the pandemic.

Since some patients experienced more than 1 ischemic event, a separate analysis was

conducted for the first ischemic events and all TIMI bleeding events to compare different races and genders. The non-AA men group was used as a baseline for comparing outcomes among all gender-based racial groups.

RESULTS

Demographics

The study included 1022 patients, with 511 undergoing PCI in the pre-pandemic period and 511 during the pandemic. The mean age of the patients ranged from 65 to 69 years. AAs were younger than non-AAs, and a higher proportion of men were observed among non-AAs than among AAs. Tobacco use was less prevalent during the COVID-19 pandemic than in the pre-pandemic period. Table 1 presents additional baseline characteristics of the cohort, which were previously reported in our earlier paper.[17]

Laboratory Parameters and Discharge Medications

During the COVID-19 pandemic, white blood cell count was lower in both AAs and non-AAs than in their respective ethnic groups before the pandemic. The highest platelet count was observed among AAs during the COVID-19 pandemic. Total cholesterol levels were higher among AAs than non-AAs before the pandemic, and AAs had significantly higher cholesterol levels during the pandemic than during the pre-pandemic period.

Ticagrelor and Clopidogrel use was higher among AAs than non-AAs in both study periods (during and before COVID-19). Angiotensin-converting enzyme inhibitor and β-blocker use increased during the COVID-19 pandemic in both ethnic groups. Additional laboratory characteristics and medications are presented in Table 2, previously reported in our earlier paper.[17]

One-year Clinical Outcomes

In total, 176 patients experienced 258 ischemic events and 32 bleeding events over a year after the index PCI. Total ischemic events, CV death, MI, and unstable angina/revascularization procedures were significantly higher during the COVID-19 pandemic ($P \leq 0.02$) (Table 3 & Fig. 1). The first occurrence of ischemic events was also higher during the COVID-19 pandemic (OR, 1.51; $P=0.01$), primarily driven by higher rates of CV death (OR, 2.56; $P=0.03$) and MI (OR, 2.06; $P=0.03$) (Table 4 & Fig. 2).

Among the patients who underwent PCI during the pandemic, 53 tested positive for COVID-19 within 1 year after the index PCI. Nine of these 53 patients experienced 13 ischemic events within 1 year of the index PCI. These 13 ischemic events included 2 CV deaths, 1 all-cause death, and 1 MI after COVID-19 infection. In contrast, before COVID-19 infection, 1 TIMI bleeding event, 5 MIs, 1 stent thrombosis, and 2 revascularization procedures occurred.

Table 1: Baseline Characteristics

	Non-AAs		AAs	
	Before COVID-19 (n=291)	During COVID-19 (n=293)	Before COVID-19 (n=220)	During COVID-19 (n=218)
Men (%)	67	70	55^{++}	53^{+++}
Age, y	69±12	68±11	65±13^{+++}	65±13^{++}
Hypertension (%)	86	79*	86	83
Hyperlipidemia (%)	79	76	70^{+}	65^{++}
Diabetes mellitus (%)	41	36	49	52^{+++}
Tobacco use (%)	50	15***	47	27***,$^{++}$
Weight (kg)	89 ± 21	87 ± 21	89 ± 20	92 ± 23
Heart failure (%)	11	9	14	18^{++}

Peripheral artery disease (%)	10	20**	11	12^{+}
Acute coronary syndromes (%)	37	40	64^{+++}	77**,$^{+++}$
STEMI (%)	15	20	23^{+}	31*,$^{++}$
NSTEMI (%)	20	20	39^{+++}	46^{+++}
Prior PCI (%)	43	35	35	34
Prior CABG (%)	24	15**	10^{+++}	16

Comparisons were made between before and during the COVID-19 pandemic within the same race. * *P*<0.05, ** *P*<0.01, *** *P*<0.001
Comparisons were made between non-AAs and AAs within the same period. + *P*<0.05, ++ *P*<0.01, +++ *P*<0.001
AAs: African Americans, STEMI: ST-elevation myocardial infarction, NSTEMI: non–ST-elevation myocardial infarction, PCI: percutaneous coronary intervention, CABG: coronary artery bypass grafting

Table 2: Baseline Laboratory Characteristics and Discharge Medications

	Non-AAs		AAs	
	Before COVID-19 (N=291)	During COVID-19 (N=293)	Before COVID-19 (N=220)	During COVID-19 (N=218)
Laboratory Characteristics at Admission				
WBCs, 1000/mm^3	12±17	9±4**	13±18	9±4**
Platelets, 1000/mm^3	234±82	235±68	226±94	259±89***,$^{+++}$
Total cholesterol, mg/dL	155 ± 44	161 ± 47	164 ± 45^{+}	181 ± 64**
HDL Cholesterol, mg/dL	45 ± 19	44 ± 12	56 ± 38^{+++}	45 ± 15***
Medications at Discharge				
Aspirin	96	96	96	94
Clopidogrel	51	54	30^{+++}	36^{+++}
Ticagrelor	38	34	64*, $^{+++}$	53^{+++}
ACEI/ARB	43	60***	49	62**
β-blockers	61	76***	67	87***,$^{++}$
CCB	20	27	24	26

AAs: African Americans, WBCs: white blood cells, HDL: high-density lipoprotein, ACEI: angiotensin-converting enzyme inhibitor, ARB: angiotensin receptor blocker, CCB: calcium channel blockers

Table 3: All Adverse Events Before and During COVID-19

Event, n, (%)	Before COVID-19 (n=511)	During COVID-19 (n=511)	OR (95% CI)	*P* value
Total ischemic events	100 (19.5)	158 (30.9)	1.84 (1.38-2.45)	<0.0001
Cardiovascular death	9 (1.8)	23 (4.5)	2.63 (1.20-5.74)	0.02
Myocardial infarction	21 (4.1)	41 (8.0)	2.03 (1.19-3.50)	0.01
Stent thrombosis	15 (2.9)	8 (1.6)	0.53 (0.22-1.25)	0.15
Revascularization	55 (10.8)	86 (16.8)	1.68 (1.17-2.41)	0.005
TIMI bleeding	19 (3.7)	13 (2.5)	0.68 (0.33-1.38)	0.28

Ischemic events were cardiovascular death, myocardial infarction, stent thrombosis and revascularization, and TIMI.

TIMI: thrombolysis in myocardial infarction

Events, n (%)	Before COVID-19 (n=511)	During COVID-19 (n=511)
Total ischemic events	100 (19.5)	158 (30.9)
Cardiovascular death	9 (1.8)	23 (4.5)
Myocardial infarction	21 (4.1)	41 (8.0)
Stent thrombosis	15 (2.9)	8 (1.6)
Revascularization	55 (10.8)	86 (16.8)
TIMI bleeding	19 (3.7)	13 (2.5)

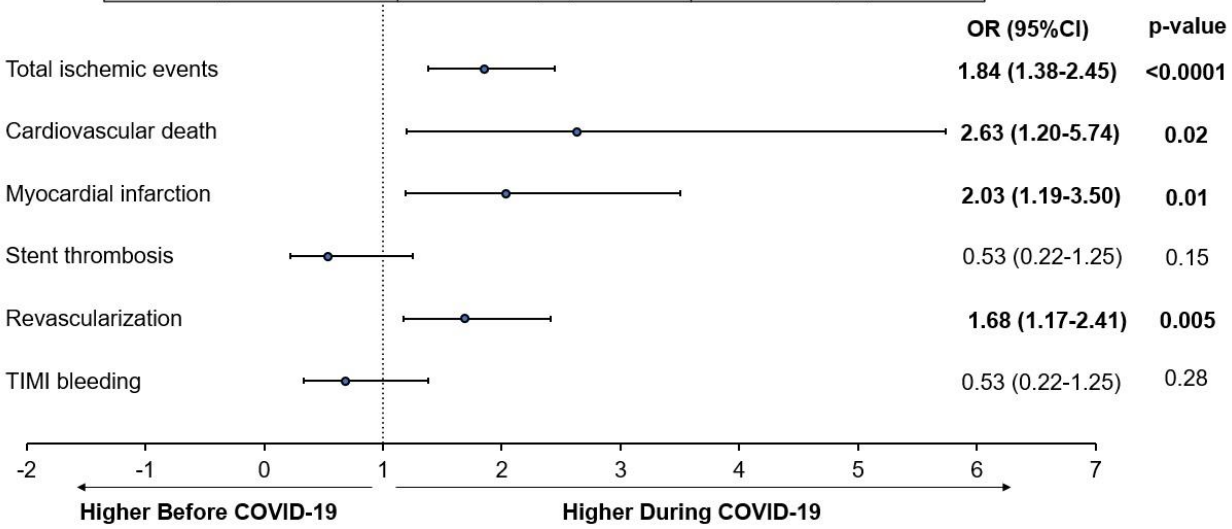

Figure 1: The forest plot depicts all 1-year post-PCI events.
TIM: thrombolysis in myocardial infarction

Table 4: The First Occurrence of Ischemic Events and All TIMI Bleeding Events Before and During COVID-19

Event, n, (%)	Before COVID-19 (n=511)	During COVID-19 (n=511)	OR (95% CI)	*P* value
Total ischemic events	73 (14.3%)	103 (20.2%)	1.51 (1.09-2.10)	0.01
CV death	8 (1.6)	20 (3.9)	2.56 (1.12-5.87)	0.03
Myocardial infarction	14 (2.7)	28 (5.5)	2.06 (1.07-3.96)	0.03
Stent thrombosis	10 (2.0)	4 (0.8)	0.39 (0.12-1.26)	0.12
Revascularization	41 (8.1)	51 (10.0)	1.27 (0.83-1.96)	0.26
TIMI bleeding	19 (3.7)	13 (2.5)	0.68 (0.33-1.38)	0.28

Ischemic events were CV death, MI, stent thrombosis and revascularization, and TIMI.

TIMI: thrombolysis in myocardial infarction, CV: cardiovascular

Events, n (%)	Before COVID-19 (n=511)	During COVID-19 (n=511)
Total ischemic events	73 (14.3%)	103 (20.2%)
Cardiovascular death	8 (1.6)	20 (3.9)
Myocardial infarction	14 (2.7)	28 (5.5)
Stent thrombosis	10 (2.0)	4 (0.8)
Revascularization	41 (8.1)	51 (10.0)
TIMI bleeding	19 (3.7)	13 (2.5)

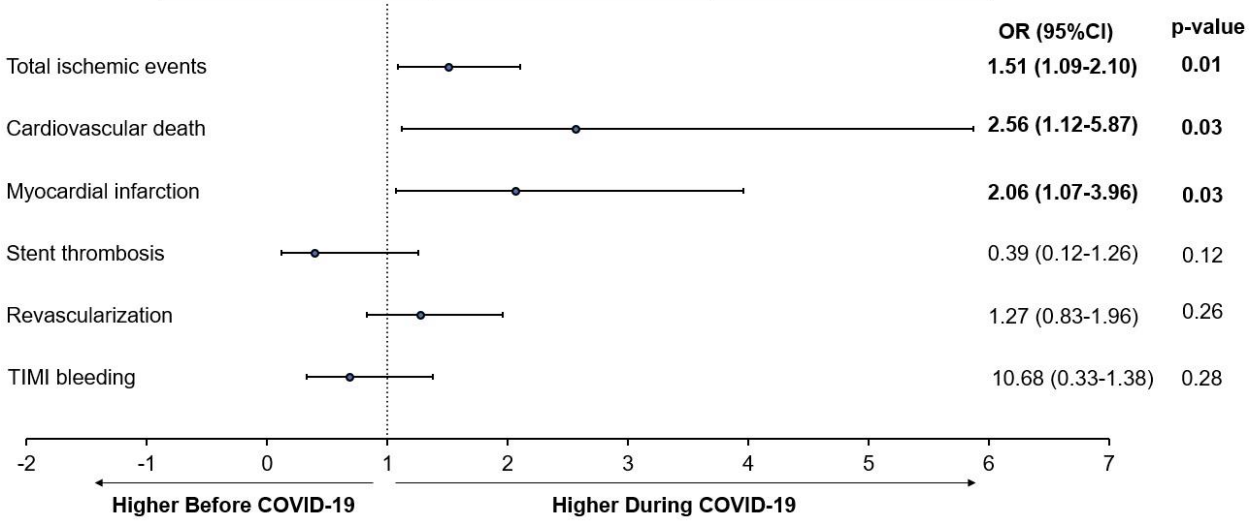

Figure 2: The forest plot depicts the first occurrence of 1-year post-PCI events.
TIMI: thrombolysis in myocardial infarction

First Occurrence of Ischemic Events and All TIMI Bleeding Events Before and During COVID-19 Within Race

No significant differences in total post-PCI adverse events were observed in non-AAs before, as opposed to during the pandemic (total ischemic events: 14.8% vs 16.7%, TIMI bleeding: 3.4% vs 2.4%; *P*=nonsignificant for both) (Table 5 & Fig. 3 & 4).

However, among AAs, the rate of the first occurrence of ischemic events was significantly higher during the COVID-19 pandemic (24.8% vs 13.6%; *P*=0.003), primarily driven by a significantly higher rate of CV death (*P*=0.02) and a trend toward a higher rate of MI (3.6% vs 6.9%; *P*=0.12) (Fig. 5).

First Occurrence of Ischemic Events and All TIMI Bleeding Events Before and During COVID-19 Between Different Races

During the COVID-19 pandemic, AAs had a significantly higher total incidence of ischemic events (24.8% vs 16.7%; *P*=0.03) than non-AAs. Nevertheless, no significant difference was observed between the 2 groups before the pandemic (13.6% vs 14.8%; *P*=0.72). No significant differences were found in individual adverse events such as CV death, MI, stent thrombosis, and TIMI bleeding among races both before and after the pandemic (*P*>0.05) (Table 6).

Comparisons of First Ischemic Events and All TIMI Bleeding

Before the pandemic, AA women had the highest rate (17.35%) of ischemic event occurrences. Still, this difference was not statistically significant compared with non-AA men before the pandemic (Supplementary S1). During the pandemic, compared with non-AA men, the highest rate of ischemic events was observed in AA men (OR, 1.94; 95% CI, 1.11 to 3.38; *P*=0.02), followed by a nonsignificant increase in AA women (OR, 1.58; 95% CI, 0.84 to 2.88; *P*=nonsignificant) (Fig. 6 & 7 & Supplementary S2).

Table 5: The First Occurrence of Ischemic Events and All TIMI Bleeding Events Before and During COVID-19 Within the Race

Event, n, (%)	AAs (n=438)				Non-AAs (n=584)			
	Before COVID-19 (n=220)	During COVID-19 (n=218)	OR (95% CI)	*P* value	Before COVID (n=291)	During COVID (n=293)	OR (95% CI)	*P* value
Total ischemic events	30 (13.6)	54 (24.8)	2.09 (1.27-3.41)	0.003	43 (14.8)	49 (16.7)	1.16 (0.74-1.81)	0.53
Cardiovascular death	3 (1.4)	12 (5.5)	4.21 (1.17-15.15)	0.02	5 (1.7)	8 (2.7)	1.61 (0.52-4.97)	0.41
Myocardial infarction	8 (3.6)	15 (6.9)	1.96 (0.81-4.72)	0.12	6 (2.1)	12 (4.1)	2.03 (0.75-5.48)	0.16
Stent thrombosis	3 (1.4)	3 (1.4)	1.01 (0.20-5.05)	1.0	7 (2.4)	2 (0.7)	0.28 (0.06-1.35)	0.09
Revascularization	16 (7.3)	24 (11.0)	1.58 (0.81-3.06)	0.18	25 (8.6)	27 (9.2)	1.08 (0.61-1.91)	0.80
TIMI bleeding	9 (4.1)	6 (2.8)	0.66 (0.23-1.89)	0.44	10 (3.4)	7 (2.4)	0.69 (0.26-1.83)	0.45

AAs: African Americans, TIMI: thrombolysis in myocardial infarction

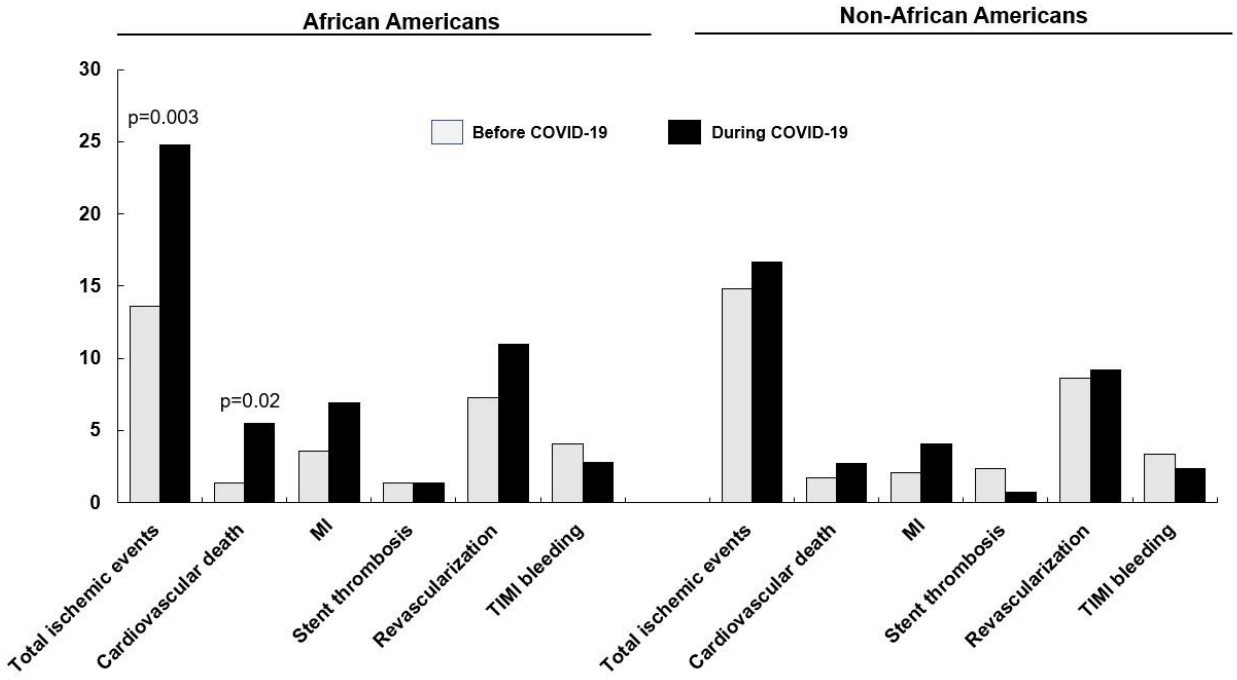

Figure 3: The bar diagram depicts the first occurrence of post-PCI adverse events by race.
MI: myocardial infarction, TIMI: thrombolysis in myocardial infarction, PCI: percutaneous coronary intervention

Events, n (%)	Before COVID-19 (n=291)	During COVID-19 (n=292)
Total ischemic events	43 (14.8)	49 (16.7)
Cardiovascular death	5 (1.7)	8 (2.7)
Myocardial infarction	6 (2.1)	12 (4.1)
Stent thrombosis	7 (2.4)	2 (0.7)
Revascularization	25 (8.6)	27 (9.2)
TIMI bleeding	10 (3.4)	7 (2.4)

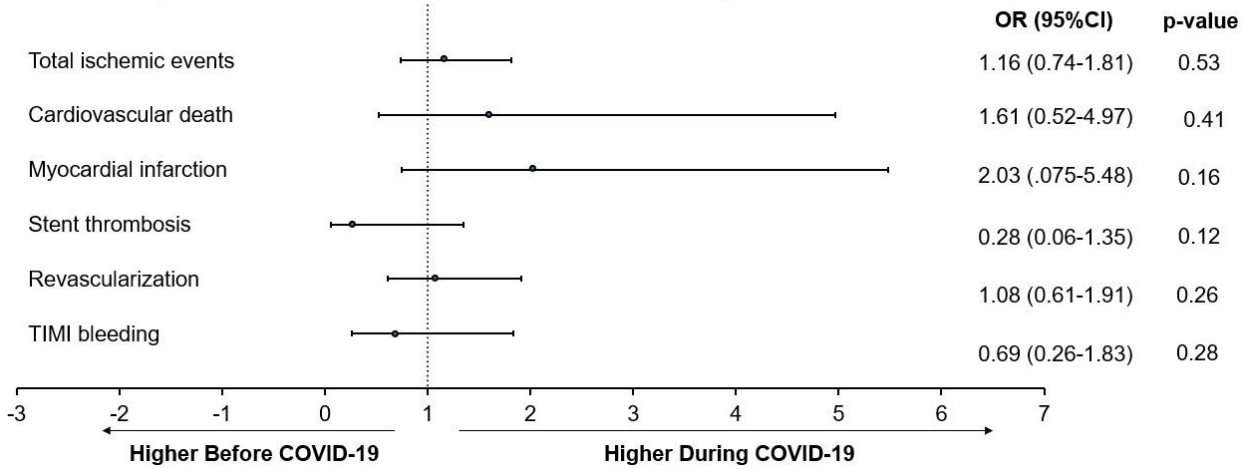

Figure 4: The forest plot depicts the first occurrence of post-PCI events in non-African Americans.
TIMI: thrombolysis in myocardial infarction, PCI: percutaneous coronary intervention

Events, n (%)	Before COVID-19 (n=220)	During COVID-19 (n=219)
Total ischemic events	30 (13.6)	54 (24.8)
Cardiovascular death	3 (1.4)	12 (5.5)
Myocardial infarction	8 (3.6)	15 (6.9)
Stent thrombosis	3 (1.4)	3 (1.4)
Revascularization	16 (7.3)	24 (11.0)
TIMI bleeding	9 (4.1)	6 (2.8)

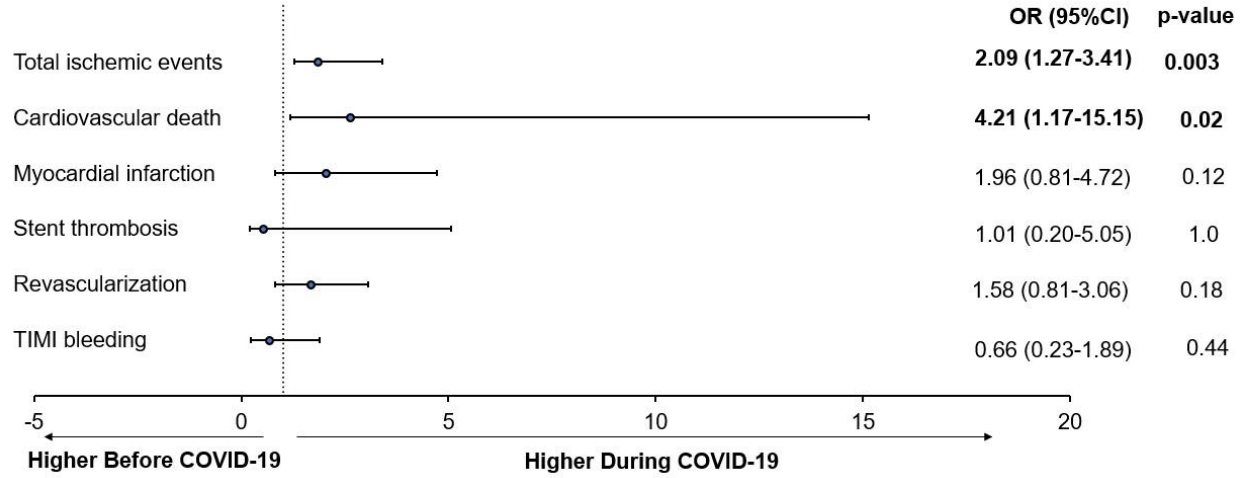

Figure 5: The forest plot depicts post-PCI adverse events in African Americans.
TIMI: thrombolysis in myocardial infarction, PCI: percutaneous coronary intervention

Table 6: The First Occurrence of Ischemic Events and All TIMI Bleeding Events by Race

Event, n, (%)	Before COVID-19 (n=511)				During COVID-19 (n=511)			
	AAs (n=220)	Non-AAs (n=291)	OR (95% CI)	*P* value	AAs (n=218)	Non-AAs (n=293)	OR (95% CI)	*P* value
Total ischemic events	30 (13.6)	43 (14.8)	0.91 (0.55-1.51)	0.72	54 (24.8)	49 (16.7)	1.64 (1.06-2.53)	0.03
CV death	3 (1.4)	5 (1.7)	0.79 (0.19-3.34)	0.75	12 (5.5)	8 (2.7)	2.07 (0.83-5.17)	0.12
Myocardial infarction	8 (3.6)	6 (2.1)	1.79 (0.61-5.24)	0.29	15 (6.9)	12 (4.1)	1.73 (0.79-3.78)	0.17
Stent thrombosis	3 (1.4)	7 (2.4)	0.56 (0.14-2.19)	0.41	3 (1.4)	2 (0.7)	2.03 (0.34-12.26)	0.44
Revascularization	16 (7.3)	25 (8.6)	0.83 (0.43-1.60)	0.59	24 (11.0)	27 (9.2)	1.22 (0.68-2.18)	0.50
TIMI bleeding	9 (4.1)	10 (3.4)	1.20 (0.48-3.00)	0.70	6 (2.8)	7 (2.4)	1.16 (0.38-3.49)	0.80

Ischemic events were CV death, MI, stent thrombosis, and revascularization.

AAs: African Americans, TIMI: thrombolysis in myocardial infarction, CV: cardiovascular

Supplementary S1: Race and Gender-Based First Ischemic Events and All TIMI Bleeding Events Before the COVID-19 Pandemic

Event, n%	Before COVID-19 (n=511)					
	Non-AA Women (n=96)	Non-AA Men (n=195)	AA Women (n=98)	AA Men (n=122)	OR (compared with non-AA men)	*P* value (compared with non-AA men)
Total ischemic events	16 (16.67)	27 (13.85)	17 (17.35)	13 (10.66)	• non-AA women-1.24(0.63-2.44) • AA women-1.30(0.67-2.53) • AA men-0.74(0.37-1.50)	• non-AA women-0.52 • AA women-0.42 • AA men-0.41
Cardiovascular death	2 (2.08)	3 (1.54)	1 (1.02)	2 (1.64)	• non-AA women-1.36(0.22-8.29) • AA women-0.66(0.07-6.43) • AA men-1.07(0.18-6.48)	• non-AA women-0.74 • AA women-0.72 • AA men-0.94
Myocardial infarction	2 (2.08)	4 (2.05)	4 (4.08)	4 (3.28)	• non-AA women-1.02(0.18-5.65) • AA women-2.03(0.49-8.30) • AA men-1.62(0.40-6.60)	• non-AA women-0.99 • AA women-0.32 • AA men-0.50
Stent thrombosis	2 (2.08)	5 (2.56)	2 (2.04)	1 (0.82)	• non-AA women-0.81(0.15-4.42) • AA women-0.79(0.15-4.16) • AA men-0.31(0.04-2.72)	• non-AA women-0.80 • AA women-0.78 • AA men-0.29
Revascularization	10 (10.42)	15 (7.69)	10 (10.20)	6 (4.92)	• non-AA women-1.39(0.60-3.23) • AA women-1.36(0.59-3.16) • AA men-0.62(0.23-1.65)	• non-AA women-0.43 • AA women-0.47 • AA men-0.34
TIMI bleeding	2 (2.08)	8 (4.10)	7 (7.14)	2 (1.64)	• non-AA women-0.49(0.10-2.39) • AA women-1.80(0.63-5.11) • AA men-0.39(0.08-1.87)	• non-AA women-0.38 • AA women-0.27 • AA men-0.24

TIMI: thrombolysis in myocardial infarction, AA: African Americans

Supplementary S2: Race and Gender-Based First Ischemic Events and All TIMI Bleeding Events During the COVID-19 Pandemic

Event, n%	During COVID-19 (n=511)					
	Non-AA Women (n=89)	Non-AA Men (n=204)	AA Women (n=101)	AA Men (n=117)	OR (compared with non-AA men)	*P* value (compared with non-AA men)
Total ischemic events	17 (19.10)	32 (15.69)	23 (22.77)	31 (26.50)	• non-AA women-1.27(0.66-2.43) • AA women-1.58(0.87-2.88) • AA men-1.94(1.11-3.38)	• non-AA women-0.47 • AA women-0.13 • AA men-0.02
Cardiovascular death	4 (4.49)	4 (1.96)	5 (4.95)	7 (5.98)	• non-AA women-2.35(0.56-9.63) • AA women-2.60(0.68-9.92) • AA men-3.18(0.91-11.11)	• non-AA women-0.23 • AA women-0.16 • AA men-0.07
Myocardial infarction	6 (6.74)	6 (2.94)	6 (5.94)	9 (7.69)	• non-AA women-2.39(0.75-7.61)	• non-AA women-0.14

					• AA women-2.08(0.65-6.63) • AA men-2.75(0.95-7.93)	• AA women-0.21 • AA men-0.06
Stent thrombosis	0 (0.00)	2 (0.98)	2 (1.98)	1 (0.85)	• non-AA women-omitted • AA women-2.04(0.28-14.70) • AA men-0.87(0.08-9.71)	• non-AA women-omitted • AA women-0.48 • AA men-0.91
Revascularization	7 (7.87)	20 (9.80)	10 (9.90)	14 (11.97)	• non-AA women-0.79(0.32-1.93) • AA women-1.01(0.45-2.25) • AA men-1.25(0.61-2.58)	• non-AA women-0.60 • AA women-0.98 • AA men-0.54
TIMI bleeding	0 (0.00)	1 (0.49)	2 (1.98)	0 (0.00)	• non-AA women-omitted • AA women-4.10(0.37-45.77) • AA men-omitted	• non-AA women-omitted • AA women-0.25 • AA men-omitted

TIMI: thrombolysis in myocardial infarction, AA: African Americans

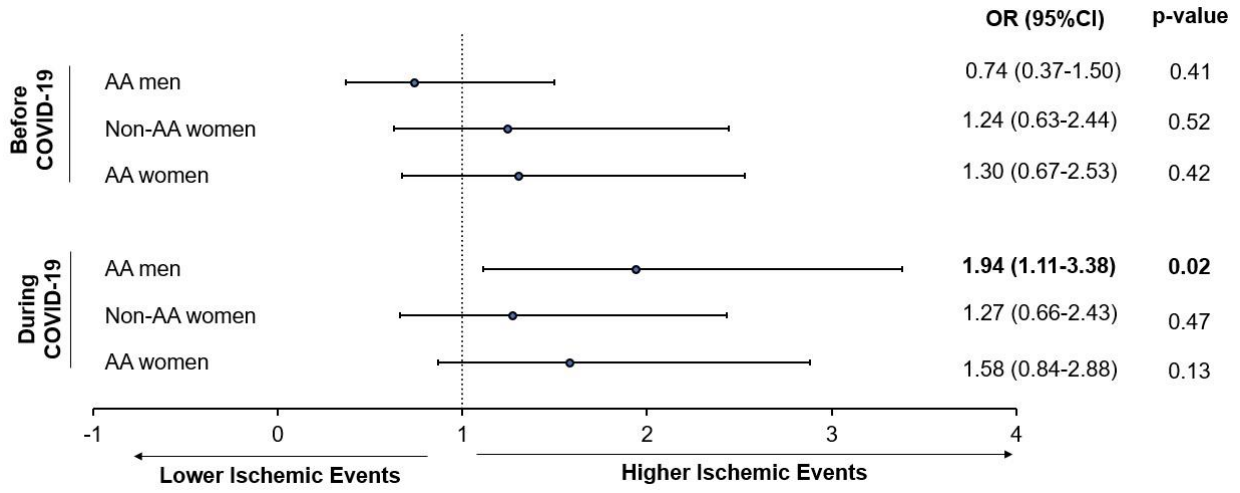

Figure 6: The forest plot depicts race-gender-based comparisons of post-PCI ischemic events (using non-AA men as comparators).
TIMI: thrombolysis in myocardial infarction, AA: African Americans, PCI: percutaneous coronary intervention

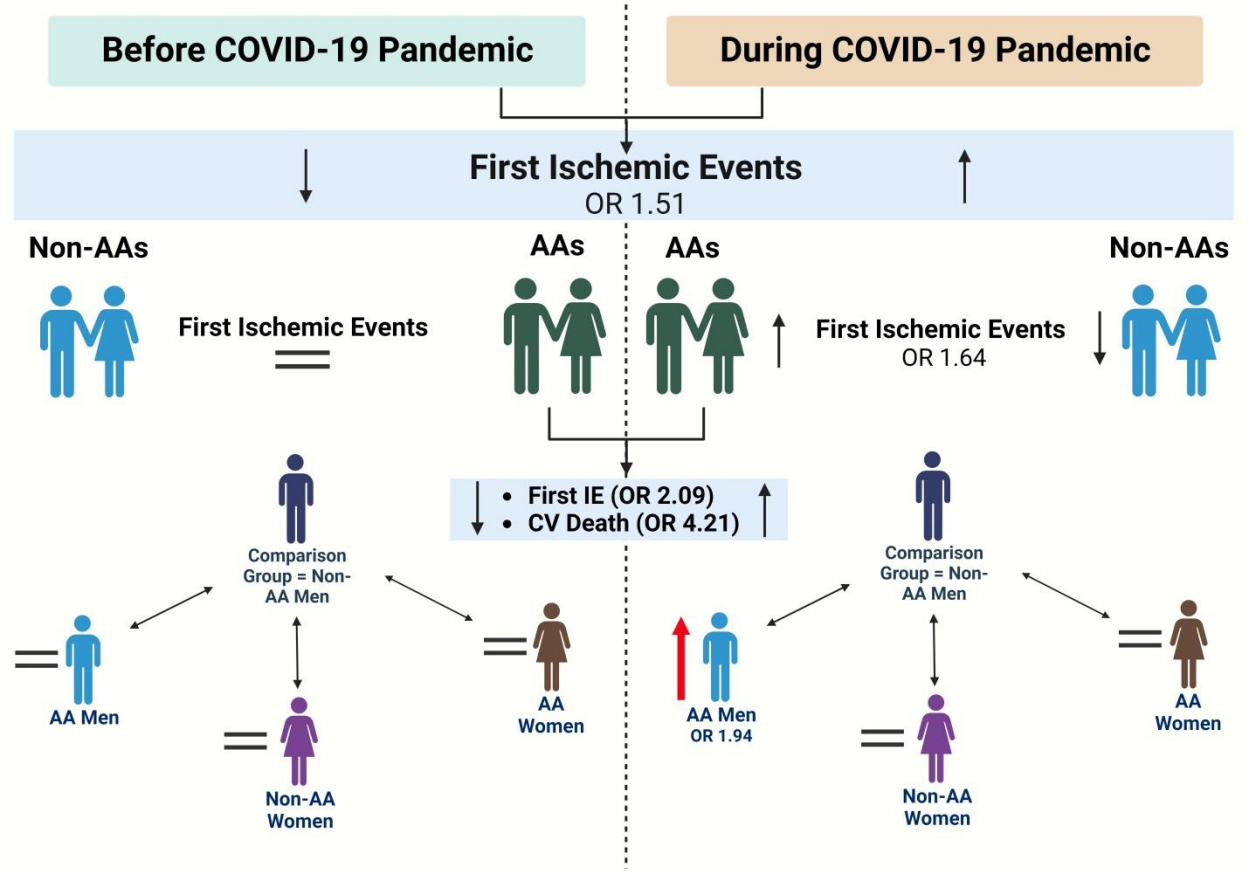

Figure 7: The Central Illustration: The key findings of the study are highlighted in the central illustration. First ischemic events (IEs) were more prevalent during the pandemic than during the pre-pandemic period (OR, 1.51). Before the pandemic, the incidence of first IE was similar between African Americans (AAs) and non-AAs. Nonetheless, during the pandemic, first IEs were more common in AAs than in non-AAs (OR, 1.64). Among AAs, the incidence of first IEs (OR, 2.09) was significantly higher during the pandemic than before the pandemic, especially for cardiovascular (CV) death (OR, 4.21). Before the pandemic, the incidence of first IEs was comparable among non-AA men, AA men, non-AA women, and AA women. During the pandemic, however, AA men (OR, 1.94) demonstrated a significantly higher incidence of first IEs than non-AA men, AA women, and non-AA women.
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DISCUSSION

This single-center retrospective cohort study yielded several noteworthy findings:

1) The first occurrences of post-PCI ischemic events were higher during the pandemic, primarily due to a higher rate of CV death and MI.
2) The incidence of first post-PCI ischemic events among non-AAs was similar before and during the COVID-19 pandemic.
3) AAs experienced a higher rate of the first occurrence of ischemic events during the pandemic, mainly driven by increased rates of CV death and a trend toward a higher MI incidence.
4) AA men demonstrated a higher incidence of ischemic events during the pandemic than AA women, non-AA women, and non-AA men.
5) AAs had a higher incidence of first ischemic events than non-AAs during the pandemic.

The COVID-19 pandemic significantly impacted admissions and overall utilization of PCI due to the severe disruption of healthcare services caused by restrictions imposed during the pandemic.[18, 19] This

negatively affected the burden of CVD. Public health officials and media discouraged people from seeking emergency treatment to limit the spread of COVID-19, resulting in approximately a 50% decrease in hospitalizations for acute CV conditions such as MI and stroke during the early pandemic period.[20–23]

Delayed symptom-to-first-medical contact and door-to-balloon times contributed to elevated CV mortality rates unrelated to COVID-19 infection.[24, 25] Moreover, studies report poor CV outcomes in COVID-19 patients with preexisting CVD.[26–28] These findings underscore the significance of balancing the need for managing CVD while addressing the challenges posed by the COVID-19 pandemic.[26, 27]

AAs have been reported to have a higher burden of CVD and associated adverse events than Caucasians.[2] AAs with acute MI are less likely to receive evidence-based treatment.[28] The COVID-19 pandemic disproportionately impacted healthcare accessibility for AAs, exacerbating existing health disparities.

During the pandemic, a relative increase of approximately 20% in mortality due to heart disease and 13% due to cerebrovascular disease was observed in non-Caucasian populations (Hispanic, Asian, and AAs) compared with Caucasians.[29] Furthermore, avoidance of urgent or emergency care was more prevalent among AAs, Hispanic adults, and uninsured individuals than among White adults.[30] These findings emphasize the need to address systemic health disparities and ensure equitable access to healthcare, particularly during challenging times like the COVID-19 pandemic. Most available randomized controlled trials underrepresent AA and Hispanic populations compared with registry reports and American Heart Association statements.[2]

The strengths of this study include its unique cohort, comprising an equal number of patients from before and during the pandemic and an equal proportion of AAs and non-AAs. This is particularly significant, as AAs have a higher prevalence of CVD than non-AAs due to a higher prevalence of CV risk factors, including hypertension, type 2 diabetes, and obesity.[31–33] Despite these disparities, the total first occurrence of post-PCI ischemic adverse events was similar among non-AAs before and during the pandemic. However, AAs experienced a higher risk of CV death and MI during the pandemic compared with the pre-pandemic period and in comparison with non-AAs. These higher adverse event rates could be attributed to differences in thrombogenicity, as AAs have been reported to have higher thromboembolism rates than White and Asian individuals and the highest platelet-fibrin clot strength, as measured by thromboelastography.[11] The latter is an independent predictor of ischemic events.

Notably, a higher intrinsic thrombogenicity was observed in COVID-19-positive patients, predominantly AAs, using thromboelastography, revealing higher platelet-fibrin clot strength, rapid fibrin generation, fibrinogen levels, and fibrin clot strength.[34] Interestingly, in contrast to a previous study demonstrating the highest overall ischemic events in AA women, the current study showed that the first ischemic events were most predominant in AA men.[17] These findings emphasize the need for further research to better understand the factors contributing to these disparities and develop targeted interventions to improve CV outcomes for AAs, particularly during difficult circumstances like the COVID-19 pandemic. The underlying thrombogenetic pathway differences could hypothetically explain these disparities. Nevertheless, further studies are required to validate our findings, as investigating these potential mechanisms is beyond the current study's scope.

Another possible reason for the disproportionately higher adverse events in AAs observed in this study could be the prevalent socioeconomic disparities. Despite no significant increase in underlying CVD risk factors among AAs during the pandemic, the disparities might be attributed to socioeconomic factors. In the United States, racial and ethnic minorities often face socioeconomic disadvantages,[35] which can influence health outcomes.

Further research should focus on the complex interplay between biological factors, such as thrombogenicity, and socioeconomic factors to develop targeted interventions for reducing health disparities and promoting health equity.

AAs are 1.5 times more likely to be uninsured than White people.[36, 37] Black, Hispanic, and American Indian individuals are more likely to hold jobs that cannot be performed remotely, such as transit workers, grocery store clerks, nursing aides, construction workers, and household workers. During the pandemic, over 40 million people in the United States filed for unemployment, with Black and Hispanic populations experiencing disproportionately higher job loss,[38] which led to worsened financial hardships among AAs and further exposed preexisting healthcare disparities.[39] These disparities affected access to routine outpatient visits and medication compliance, potentially predisposing an already disadvantaged population to higher adverse outcomes during the pandemic.

Study Limitations: It is essential to consider the following limitations when assessing the results of this study:

The manual data collection process may be susceptible to observer bias. To minimize bias, multiple authors (SD, PK, JA, and US) cross-checked the data.

The study's small sample size and single-center design led to overfitting in the multivariate regression model, rendering it unsuitable for the final analysis.

Baltimore's substantial AA population compared with the national average should be taken into account when comparing the results with national-level studies.

The data were primarily collected during the early phase of the pandemic, and the overall COVID-19 positivity rate among patients was low, with most infections occurring in the post-PCI period. Thus, the findings should be interpreted as reflecting the impact of pandemic-related changes rather than being directly attributed to COVID-19 infection.

CONCLUSIONS

This single-center study investigated post-PCI patients, with an equal proportion of AAs and non-AAs. AAs experienced a high rate of post-PCI ischemic events during the COVID-19 pandemic compared with before the pandemic period, principally due to increased CV death and MI rates. AAs also had higher ischemic events than non-AAs during the pandemic.

The underlying pathophysiology of the higher thrombogenicity risk among AAs warrants further investigation. This study may contribute to strengthening the available data and allocating resources more effectively in response to future pandemics.

Disclosures:

Dr Gurbel receives consulting fees and/or honoraria from Bayer, Vectura/Otitopic, Janssen, UpToDate, Cleveland Clinic, Adeno, Wolters Kluwer Pharma, Web MD Medscape, Baron and Budd, North American Thrombosis Forum, Innovative Sciences; institutional research grants from the Haemonetics, Janssen, Bayer, Instrumentation Laboratories, Amgen, Idorsia, Otitopic, Hikari Dx, Novartis, Precision Biologic, Nirmidas Biotech, and R-Pharma International. In addition, Dr

Gurbel has 2 patents: Detection of Restenosis Risk in Patients and Assessment of Cardiac Health and Thrombotic Risk in a Patient. Dr Gurbel was an expert witness in a lawsuit associated with Plavix.

Conflict of Interest: None

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